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Impact of social isolation during the COVID-19 pandemic on the mental health of university students and recommendations for the post-pandemic period: A systematic review

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ABSTRACT

Introduction: Investigating the psychological impact caused by the interruption of social interactions on university students during the pandemic is essential, with a view to developing strategies to preserve mental health and academic performance.
Objective: To analyze the impact of social isolation during the COVID-19 pandemic on the mental health of university students and propose recommendations for the post-pandemic period.
Method: This systematic review was conduced in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and was registered in the International Prospective Register of Systematic Reviews (PROSPERO). Database searches were performed up to December 2024 in PubMed, EMBASE, Web of Science, Scopus, CINAHL, and PsycNET, using the terms "COVID-19," "social isolation," "mental health," and "college students." Studies were excluded if they focused on non-college populations, other causes of social isolation, physical health, or specific designs.
Results: The initial search identified 3051 records and 68 studies were included in this review, with sample off 177,537 university students. Anxiety was the most commonly investigated variable (79.4%), followed by depression (75%) and stress (42.6%). Less frequently, studies highlighted the increase in alcohol and drug consumption and suicidal ideation. Some authors also investigated sleep quality, relating insomnia and emotional changes with the reduction in physical exercise. Anxiety symptoms related to online learning directly impacted academic performance. The assessment of the risk of bias showed that of the 68 studies included, 34 had a low risk of bias, 30 had a moderate risk of bias, and 4 had a high risk of bias.
Conclusion: This study highlights the negative impact of the COVID-19 pandemic on the mental health of college students, particularly in relation to symptoms of anxiety, depression, and stress. Post-pandemic interventions should prioritize fostering healthy habits, such as ensuring quality sleep, engaging in moderate physical activity, and raising mental health awareness. Additionally, universities should implement proactive support systems to cultivate a safe and inclusive environment for students.

1. Introduction

The COVID-19 pandemic has had a significant impact on people's lives around the world, particularly after the World Health Organization declared a global pandemic on March 11, 2020 (Cascella et al., 2023). Due to the lack of vaccines and antiviral drugs available, quarantine and isolation procedures for those exposed to or infected by the disease and social distancing for the entire population were used as strategies to reduce its transmission (Haug et al., 2020). Without precise knowledge of the extent of the pandemic, educational systems around the world experienced widespread closure of their educational institutions (Gusso et al., 2020).

Universities, academic departments, and university courses had to adapt and carry out activities remotely, with students in social

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distancing, in order to reduce pedagogical harm and public health risks (Campos et al., 2021). This confinement, despite its benefits, has had an impact on students, putting them at risk of developing psychological and mental health problems (Usher et al., 2020). Although physical confinement has had some positive effects on the physical and mental health of various populations (Andrade et al., 2020; Dominski et al., 2021; Vilarino et al., 2021), with impaired practice of activities, students of all ages have suffered losses in their quality of life.

Depression, anxiety, stress, and mood swings are symptoms commonly associated with a pandemic context (F. B. Chen et al., 2020), and mental health problems are at least twice as prevalent in these circumstances (Fisher et al., 2020). The confinement imposed by COVID-19, described as the "world's largest psychological experiment" (Van Hoof, 2020), impacted diverse populations and in different contexts (D'Oliveira et al., 2022), including the population of university students, who presented symptoms of anxiety and depression (Campos et al., 2021), suicidal ideation, severe distress, and high levels of perceived stress (Wathelet et al., 2020).

Investigating the impacts of the COVID-19 pandemic lockdown on the mental health of university students is of the utmost importance, given the challenges of interrupting student interactions and the adaptations needed in teaching, research, and outreach. A systematic review aimed at summarizing and describing these impacts would allow us to understand the impacts of isolation and social distancing on mental health and the development of future strategies to preserve the academic performance and health of these students, contributing to effective interventions with long-term benefits. Given the above and the relevance of the topic, the present study aims to analyze the impact of social isolation during the COVID-19 pandemic on the mental health of university students and propose recommendations for the post-pandemic period.

2. Methods

This is a systematic literature review that followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses literature search extension (PRISMA-S) (Rethlefsen et al., 2021) registered in the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42022343228).

2.1. Search strategy

Searches for articles were carried out in scientific journals indexed in the PubMed (National Library of Medicine and National Institutes of Health), Embase, Web of Science, Scopus, CINAHL (Cumulative Index to Nursing and Allied Health Literature), and PsycNET databases, from their creation until December 2024, and the descriptors are presented in Table 1.

The search and selection procedures for articles were performed by two researchers (TBM and JHLB) independently. Disagreements were resolved by a third researcher (AA).

Table 1
Search strategy.

Search terms	Descriptors
1. COVID-19	COVID-19 OR Pandemic COVID-19 OR SARS-CoV-2 Infection OR Coronavirus Disease 2019
2. Social isolation	Social isolation OR Social Exclusion OR Social Exclusions OR social deprivation
3. Mental health	Mental health
5. College students	Universities OR postsecondary OR tertiary OR undergraduate OR College students OR University students
Combination	

2.2. Eligibility criteria

Only peer-reviewed studies were included, taking into account the criteria based on the PECOS statement (Population, Exposure, Comparison, Outcome, and Study design) (Morgan et al., 2018) (Table 2).

2.3. Study selection and data extraction

At this stage of the review, Rayyan software, developed by the Qatar Computing Research Institute (Ouzzani et al., 2016), was utilized. The selection and data extraction processes were independently carried out by two researchers (TBM and JHLB) to ensure objectivity and minimize potential bias. Any disagreements during these steps were resolved through consensus discussions.

For the analysis and discussion of the results, the following data were extracted: author and year of publication; type of study; country; sample characteristics (number of participants, age, and sex); undergraduate course; psychological and mental health variables affected; instrument for assessing these variables; main results; and conclusion of the study.

2.4. Study quality assessment

To assess the quality of the included studies, the JBI critical appraisal checklist for randomized controlled trials, cohort studies, and cross-sectional studies (Santos et al., 2018) was used. In the JBI critical appraisal checklist, each question is answered by selecting from four options: yes (Y), no (N), unclear (U), and not applicable (NA). The percentage risk of bias is calculated by the number of "Y" responses in the checklist. When the selected response is "NA," the question is not considered for the calculation. In the final sum, 0%–49% is considered as a high risk of bias, from 50% to 70% as a moderate risk, and above 70% as a low risk of bias.

The assessment was performed by two researchers (TBM and JHLB) independently. When necessary, a third author (AA) was asked for the final opinion, and disagreements were resolved by consensus. The quality of the study was not considered as an inclusion or exclusion criterion.

3. Results

The search strategy identified 3051 studies. After removing duplicates, 2384 studies remained. Screening of abstracts identified 123 potentially eligible studies. Finally, a total of 68 original studies met the inclusion criteria (Fig. 1).

3.1. Study characteristics

This systematic review included 68 studies, involving a total of 177,537 university students from 29 countries, such as Argentina, Australia, Brazil, Canada, China, France, Germany, and the United States, among others. This global scope highlights the widespread interest in exploring the pandemic's impact on university students' mental health.

Most studies (92.6%, n = 63) included both male and female students, while 1.5% (n = 1) focused exclusively on females, and 5.9% (n =

Table 2
Eligibility criteria for the inclusion of reviews.

		Inclusion criteria	Exclusion criteria
P	Population	University students	Schoolchildren, graduates
E	Exposure	COVID-19 pandemic and lockdown	Other causes of social isolation
C	Comparison	–	–
O	Outcome	Mental health	Physical health
S	Study design	Clinical trial, cohort, cross-sectional	Systematic review, qualitative study, case study, protocols

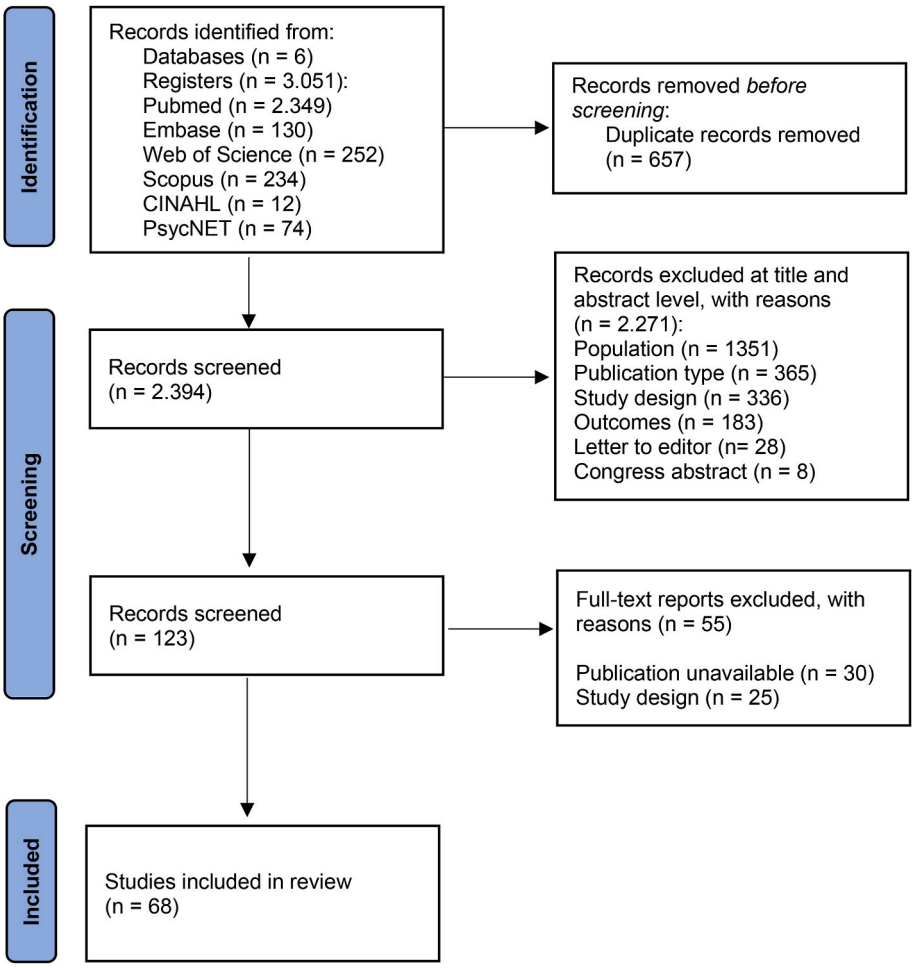

Fig. 1. Study flowchart following PRISMA guidelines.

4) did not specify the participants sex. Age data were reported in 60.3% (n = 41) of the studies, whereas 39.7% (n = 27) did not provide this information.

In terms of study design, 85.3% (n = 58) were cross-sectional, 13.2% (n = 9) were cohort studies, and 1.5% (n = 1) used a quasi-experimental design. Regarding undergraduate courses, 35.3% (n = 24) covered "several" courses, 23.5% (n = 16) did not specify the course, 5.9% (n = 4) focused on Nursing, 4.4% (n = 3) on Medicine, and 30.9% (n = 21) included multiple courses (Table 3).

3.2. Characteristics of the instruments used

This systematic review employed a range of established instruments to assess the impact of the COVID-19 pandemic on the mental health of university students, reflecting a rigorous approach to this critical topic. Among the 68 included studies, two instruments were specifically developed for pandemic-related research: the COVID-19 Pandemic Anxiety Scale (Appleby et al., 2022) and the Coronavirus Anxiety Scale (CAS) (Mushtaque et al., 2022).

The Depression Anxiety and Stress Scale (DASS-21) was the most frequently used instruments for evaluating anxiety, depression, and stress, appearing in 14 studies (20.5%). The Perceived Stress Scale (PSS) was applied in 8 studies (11.7%), while the Beck Depression Inventory - Second Version (BDI-II) and the Zung Self-Rating Anxiety Scale (Z-SAS) were each utilized in 5 studies (7.3%). Other instrum included the State-Trait Anxiety Inventory (STAI) in 4 studies (5.8%) and the Epidemiologic Studies of Depression-10 (CES-D-10) in 3 studies (4.4%).

For depression and anxiety specifically, the Generalized Anxiety Disorder 7 (GAD-7) was the most widely employed instrument, appearing in 12 studies (17.6%), followed by the Patient Health Questionnaire (PHQ-9) in 9 studies (13.2%) and the Beck Anxiety Inventory in 1 study (1.5%). Additionally, 4 studies (5.8%) developed customized self-reported questionnaires tailored to their research objectives, emphasizing the importance of bespoke instruments in addressing the unique psychological challenges faced by university students during the pandemic.

3.3. Anxiety, depression and stress

Anxiety was the most frequently investigated psychological variable among university students during the COVID-19 pandemic, reported in 79.4% of studies, followed by depression (75%) and stress (42.6%). These findings emphasize the significant mental health burden that students faced, with anxiety being the most prevalent issue. While depression and stress were also major concerns, anxiety stood out as the dominant challenge for this population during the pandemic.

Several studies have documented a significant increase in anxiety and depression during the pandemic. For instance, anxiety levels rose from 18.1% before the pandemic to 25.3% in the first four months of social isolation, and depression increased from 21.5% to 31.7% in the same period (Fruehwirth et al., 2021). After six months, depression continued to rise, with some authors reporting an increase in the second year of the pandemic (Meda et al., 2021), while anxiety showed a reduction (McLafferty et al., 2021). Despite this decrease, anxiety levels remained above clinical limits (Chen and Lucock, 2022; Ortenburger et al., 2021), as did depression (Liu et al., 2021). The presence of social

Table 3
Revised articles found in the literature survey.

Reference; study design	Country	Sample Size	Age and sex (mean/ SD/%)	Graduation course	Mental health variables	Instrument	Main results	Conclusion
Abdullah et al. (2021); cross-sectional	Malaysia	316	Age: 29.51 (6.16) M: 95; F: 221	Medical science-based; Medicine-based	Depression, anxiety, stress	DASS-21	Depression, anxiety and stress scores are not high in this population during the COVID-19 pandemic.	COVID-19 has affected the QoL of university students during the COVID-19 pandemic, however, psychological variables are not increased.
Alsoghair et al. (2023); cross-sectional	Saudi Arabia	441	20 to <23 age: 215 (63.4%) M: 195; F: 210	Public Health and Informatics; Architecture and Planning; Arabic Language and Social Studies	Depression, anxiety	PHQ-9; GAD-7	The prevalence of depression and anxiety was 40.6% and 29.4%, respectively. Females had higher levels of depression and anxiety than men ($p < 0.001$).	Need for psychological intervention programs for the students of Qassim University.
Amerio et al. (2022); cross-sectional	Italy	8177	Age: NR M: 4095; F: 4082	Scientific–technologica	Depression, anxiety	PHQ-9; GAD-7; ISI	Of the 8177 students, 12.8% reported depressive symptoms, 25.6% anxiety, 8.7% insomnia.	A factor analysis should be carried out to early detect peculiar care needs, and plan interventions focused on the health of the population.
Appleby et al. (2022); cross-sectional	Canada	3013	Age: NR M: 868; F: 2111 O: 34	Various	Anxiety	COVID-19 Pandemic Anxiety Scale	Many students described feelings of anxiety, loneliness and restlessness associated with social isolation.	It is important to address student areas of interest and student aspects impacted by the pandemic, in order to maintain well-being and university success.
Arsandaux et al. (2021); cross-sectional	France	1335	Age: 23.3 (3.9) F: 79.8%	Various	Depression, anxiety, stress	PHQ-9; GAD-7; PSS	Student status was associated with a higher frequency of depressive, anxiety symptoms and perceived stress.	College students were at higher risk of mental health disturbances during lockdown than non-students.
Baiu et al. (2020); cross-sectional	Romania	1978	Age: NR Sex: NR	Medical	Depression, stress	Self-reported questionnaire	Multiple factors contribute to undergraduate students' mental health: partner status and offline contact, personality traits, social media, and use of streaming platforms.	More research must be carried out and appropriate measures must be taken to prevent the degradation of mental health in medical students in pandemic circumstances.
Baloch et al. (2021); cross-sectional	Pakistan	494	Age: NR M: 193 (39%) F: 301 (61%)	Various	Anxiety	Z-SAS	Among the respondents, 125 (25.3%), 45 (9.1%) and 34 (6.9%) experienced minimal to moderate, severe, and most extreme levels of anxiety, respectively.	Although both male and female students encountered stress and anxiety, females suffered higher levels of anxiety.
Barros and Sacau-Fontenla (2021); cross-sectional	Portugal	923	Age: 20.6 (4.2) M: 266 (28.8%) F: 657 (71.2%)	NR	Depression, anxiety, stress	DASS-21	The results show a strong direct effect of gender on mental health.	The pandemic situation can have a very different impact on both sexes, changing competences, skills, and behavior patterns or if we are looking at a generational evolution on gender differences.
Bijulakshmi et al. (2020); cross-sectional	India	775	Age: NR M: 295 (54.2%) F: 480 (68.6%)	Engineering; medicine	Stress	PSS	College students were experiencing significant amount of stress with 11.5 % experiencing high stress and 81.2 % students experiencing moderate amount of stress.	College students are experiencing moderate to high level of stress in the context of the pandemic situation and preventive and protective measures have to be taken by the college administration to address these issues.
Bussone et al. (2020); cross-sectional	Italy	68	Age: NR M: 10 F: 58	NR	Depression, anxiety, stress	PSS; STAI-Y; SCL-90-R	Psychological health and stress management deteriorated across the entire sample during confinement.	The general deterioration of psychological health in the entire sample demonstrates the pervasiveness of this stressor, a decline that is partially modulated by attachment style and parental bonding.
B. F. Chen et al., 2020; cross-sectional	China	992	Age: 19.4 (1.4)	NR	Depression	5-point scale	The isolation policy has had a complex influence on the symptoms of	The paper also proposes a six-step intervention strategy to alleviate young

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Table 3 (*continued*)

Reference; study design	Country	Sample Size	Age and sex (mean/ SD/%)	Graduation course	Mental health variables	Instrument	Main results	Conclusion
			M: 468 (47.2%) F: 524 (52.8%)				obsessive-compulsive disorder, hypochondria, depression and neurasthenia via various factors.	people's psychological problems while in isolation.
Chen and Lucock (2022); cross-sectional	United Kingdom	1173	Age: 25.7 (8.9) M: 340 (29%) F: 826 (70.4%)	Various	Anxiety	GAD-7	The paper found high levels of anxiety and depression, with more than 50% experiencing levels above the clinical cut offs, and females scoring significantly higher than males.	Higher levels of distress were associated with lower levels of exercising, higher levels of tobacco use, and a number of life events associated with the pandemic and lockdown, such as cancelled events, worsening in personal relationships and financial concerns.
Chi et al. (2020); cross-sectional	China	2038	Age: 20.5 (91.9) M: 755 (37%) F: 1283 (63%)	Science, engineering, education, law, literature	Anxiety	Z-SAS	Prevalence of posttraumatic stress disorder (PTSD), anxiety, and depressive symptoms, and posttraumatic growth (PTG) was 30.8, 15.5, 23.3, and 66.9% respectively.	A significant proportion of young adults exhibit clinically relevant posttraumatic PTSD, anxious or depressive symptoms.
Chinna et al. (2021); cross-sectional	Malaysia	3679	Age: NR M: 1519 (41.3%) F: 2160 (58.7%)	NR	Anxiety	Z-SAS	Overall, 21.9% and 13.7% of the students in the study experienced mild to moderate and severe to extreme levels of anxiety.	Stressors are predominantly financial constraints, remote online learning, and uncertainty related to their academic performance, and future career prospects.
Deng et al. (2020); cross-sectional	China	1607	Age: NR M: 1041 (64.8%) F: 566 (35.2%)	NR	Depression, anxiety, stress	DASS-21	The average scores of the DASS-21 subscales (2.46 for depression, 1.48 for anxiety, and 2.59 for stress) were significantly lower in the study	Mental status was significantly correlated with regular exercise and sufficient exercise duration.
Deng et al. (2021); cross-sectional	China	3219	Age: NR M: 730 (24.3%) F: 2268 (75.7%)	NR	Depression, anxiety	Z-SAS; Z-SDS	The results showed that COVID-19-related stress directly influenced sexual compulsivity symptoms (SCS), and there was an indirect influence via depression and anxiety.	The COVID-19-related stress, the higher the SCS, and the longer-lasting effect was associated with anxiety in undergraduates.
Dogan-Sander et al. (2021); cross-sectional	Germany	5642	Age: NR M: 1642 (29.1%) F: 3915 (69.4%) O: 85 (1.5%)	Medicine, law	Depression	PHQ-9	There were significant differences in severities of depressive symptoms and alcohol and drug consumption between the two online surveys from 2020 to 2021.	The study reveals an increase in severities of depressive symptoms, including suicidal ideation, drug and alcohol consumption among students.
Ehmke et al. (2022); cross-sectional	USA	2028	Age: 20.7 (3.2) M: 25.6% F: 74.4%	NR	Depression	HANDS	The paper reveals students' mental health and life satisfaction were reduced due to a paucity of personal and environmental resiliency resources.	Women were more likely than men to be adversely affected by reduced resiliency resources.
Elmer et al. (2020); cohort	Switzerland	336	Age: NR M: 12.1% F: 87.9%	Engineering, natural science	Depression, anxiety, stress	CES-D; GAD-7; PSS	Students' levels of stress, anxiety, loneliness, and depressive symptoms got worse, compared to measures before the crisis.	Female students appeared to have worse mental health trajectories when controlling for different levels of social integration and COVID-19 related stressors.
Evans et al. (2021); cohort	United Kingdom	254	Age: NR M: 32 F: 219 O: 3	Psychology	Depression, anxiety	HADS	The paper showed a significant rise in depression symptoms and a reduction in well-being at lockdown. Sleep quality was not affected across the sample as a whole.	Results highlight the urgent need for strategies to support young people's mental health.

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Table 3 (*continued*)

Reference; study design	Country	Sample Size	Age and sex (mean/ SD/%)	Graduation course	Mental health variables	Instrument	Main results	Conclusion
Faez et al. (2020); cross-sectional	Malaysia	619	Age: NR M: 445 (71.8%) F: 174 (28.1%)	Science	Depression, anxiety, stress	DASS-21	About 65%, 67.21%, and 59.29% of the students reported having depressive, anxiety, and stress symptoms respectively.	The paper showed that most of the students' mental health was greatly impacted by the lockdown due to COVID-19.
Fedorenko et al. (2021); cross-sectional	USA	608	Age: 20.2 (2.1) M: 27.8% F: 72.2%	Psychology	Depression, anxiety, stress	DASS-21; SHAI	Multiple anxiety-related vulnerabilities are potential intervention targets for reducing viral contamination fears.	Depression is a potential intervention target for social distancing fears. Females might be at greater risk for both types of fears.
Fila-Witecka et al. (2021); cross-sectional	Poland	980	Age: 22.2 (2.4) M: 247 (25%) F: 733 (75%)	Various	Depression, anxiety, stress	GHQ-28; IES-R	The results indicate that protective factors include maintaining a daily routine, staying physically active, following a usual eating pattern and taking care of sleep hygiene.	Based on the results were able to establish a list of protective and risk factors influencing the everyday life and psychological well-being of students amidst the COVID-19 pandemic.
Fila-Witecka et al. (2022); cross-sectional	Poland	1111	Age: 22.2 (2.4) M: 269 (24.3%) F: 842 (75.7%)	Various	Depression, anxiety, stress	GHQ-28; IES-R	A significant positive correlation was observed between the severity of insomnia symptoms and posttraumatic stress disorder symptoms, increased substance use, and decreased physical activity.	Although the symptoms of insomnia, as well as the severity of sleep disturbance, significantly correlated with all the investigated variables, the direction of those associations remains to be established.
Freyhofer et al. (2021); cohort	Netherlands	881	Age: 18.5 (1.2) M: 59.7% F: 40.3%	Business administration	Depression, anxiety	PHQ-9; GAD-7	Loneliness partially mediated the trajectory of depression and anxiety, and procrastination fully mediated the impact of depression on academic performance.	Educational researchers can test strategies to reduce the adverse effects of stressful situations in learning environments by targeting maladaptive coping behaviors and procrastination.
Fruehwirth et al. (2021); cross-sectional	USA	419	Age: NR M: NR F: NR	NR	Depression, anxiety	PHQ-8; GAD-7	The prevalence of moderate-severe anxiety increased from 18.1% before the pandemic to 25.3% within four months after the pandemic began; and the prevalence of moderate-severe depression increased from 21.5% to 31.7%.	Colleges may be able to reduce the mental health consequences of COVID-19 by investing in resources to reduce difficulties with distance learning and reduce social isolation during the pandemic.
Fu et al. (2021); cross-sectional	China	89588	Age: NR M: 39194 (43.7%) F: 50394 (56.2%)	NR	Anxiety	GAD-7	In the study, 36,865 students (41.1%) reported anxiety symptoms.	About two-fifths of Chinese college students experienced anxiety symptoms during the COVID-19.
Gallego-Gómez et al. (2020); cross-sectional	Spain	138	Age: 20 (19–23) M: 21.7% F: 78.3%	Nursing	Stress	SSI-SM	Stress increased substantially during lockdown. Financial, family or emotional problems, as well as physical exercise, also increased.	This could be triggered by students' personal problems, and physical exercise may be used as a way to reduce stress.
Gao et al. (2021); cross-sectional	China	702	Age: NR M: 111 (28.6%) F: 276 (71.3%)	Medical	Depression, anxiety, stress	DASS-21	In total, 24.5% of medical students were suffering anxiety to different degrees of severity, 13.1% were suffering depression in the first survey.	Measures are required to prevent increases in mental health problems in medical students.
Gestsdottir et al. (2021); cross-sectional	Norway	118	Age: NR M: 63 F: 54 O: 1	NR	Depression, anxiety,	GAD-7; SCL-90	Males had fewer symptoms of anxiety and depression, and their self-esteem was higher than females ($p < 0.05$).	University students estimated their mental and physical health to have deteriorated during the pandemic.

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Table 3 (*continued*)

Reference; study design	Country	Sample Size	Age and sex (mean/ SD/%)	Graduation course	Mental health variables	Instrument	Main results	Conclusion
Giovenco et al. (2022); cross-sectional	USA	7012	Age: NR M: 2007 (29%) F: 4999 (71%)	NR	Depression	CES-D-10	In total, 64% reported self-isolating most or all of the time and 64% reported symptoms of depression.	Universities should prioritize student mental health and prepare support services to mitigate mental health consequences of the pandemic.
Giusti et al. (2020); cross-sectional	Italy	103	Age: NR M: 19 (18.4%) F: 84 (81.6%)	Various	Depression, anxiety	Z-SAS; BDI-II	In total, 36% of student sample reported being suffering from anxiety symptoms, whereas 26% showed depressive symptomatology.	The implementation of psychological interventions to improve the mental health of vulnerable young subgroups to contain the structuring of psychopathological profiles represent a fundamental challenge.
Gonçalves et al. (2021); cross-sectional	Brazil	497	Age: 21.7 (2.8) M: 25.4% F: 74.9%	NR	Anxiety, stress	Questionnaire on the perception of social isolation by university students during COVID-19 quarantine	Participants noticed anxiety (15.3%), stress (7.3%) and altered sleep (7.6%).	Institutions should implement preventive activities regarding students' mental health and adapt remote earning in order to reduce student's distress.
Gopalan et al. (2022); cohort	USA	1004	Age: NR M: NR F: NR	NR	Depression, anxiety	CES-D-10; CCAPS-62	Feelings of belonging buffered depressive symptoms and to a lesser extent anxiety amidst COVID among all students.	College students 'sense of belonging continues to be an important predictor of mental health even amidst the pandemic, conveying the importance of an inclusive climate.
Graupensperger et al. (2020); cross-sectional	USA	135	Age: NR M: 37% F: 63%	NR	Depression	8-item short-form depression scale	The student-athletes' change in athletic identity mediated the effects of teammate social support on psychological well-being and depression symptoms.	The paper demonstrates the value in remaining socially connected with peers and maintaining role identities during the COVID-19 pandemic.
Holm-Hadulla et al. (2021); cross-sectional	Germany	2137	Age: NR M: 31.8% F: 66.5% O: 1.7%	NR	Depression, anxiety	WHO-5; PHQ-D	72.2% of the respondents feel seriously impaired in their well-being. Depression was found in 41.8% of the respondents.	Students suffer severely from the pandemic-related social restriction.
Husky et al. (2020); cross-sectional	France	291	Age: 19 (1.7) M: 72 (24.7%) F: 219 (75.3%)	Social Sciences, Health Sciences, Technology, Law and Economics	Anxiety, stress	5-point Likert scale	The sample experienced increased anxiety as well as moderate to severe stress during confinement.	Knowledge of confinement effects may be used to reduce its negative impact in vulnerable populations.
Johansson et al. (2021); cohort	Sweden	1836	Age: 26.5 (6.8) M: 27% F: 73%	Medical, economic, technical, sport science	Depression, anxiety, stress	DASS-21	The study found small differences in mean levels of the depression, anxiety and stress scale over time.	Symptom levels were relatively stable during the first three months of the pandemic, while there was a slight decrease during the summer months, probably due to seasonality effects.
Keshavarzi et al. (2021); cross-sectional	Malaysia	383	Age: NR M: 166 (43.3%) F: 217 (56.7)	NR	Stress	PSS	About 40% of the respondents reported moderate to severe level of loneliness and social isolation.	Loneliness and feeling social isolation were the most prevalent problems, as reported by the students.
Kotera et al. (2021); cross-sectional	United Kingdom	182	Age: 30 (8.3) M: 30 (8%) F: 144 (92%)	Nursing	Depression, anxiety, stress	DASS-21	Mental health problems were positively related to shame and negatively related to self-compassion and sleep.	Nurses and nursing students are required to work irregular hours and mental distress can cause serious consequences in clinical practice.
Leaune et al. (2022); cross-sectional	France	1765	Age: 21.8 (4.1)	Medical, nursing, pharmacy	Depression, anxiety	BDI-SF; STAI-A	19.5% of participants reported traumatic symptoms, 11.6% depressive	Students exhibited high levels of self-reported mental health problems and a poor

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Table 3 (*continued*)

Reference; study design	Country	Sample Size	Age and sex (mean/ SD/%)	Graduation course	Mental health variables	Instrument	Main results	Conclusion
			M: 318 (18.2%) F: 1433 (81.8%)				symptoms, 58.1% anxiety symptoms, and 4.4% suicidal ideation.	mental health-related quality of life during the early stage of the COVID-19 pandemic.
Li et al. (2022); cross-sectional	China	6027	Age: NR M: 2509 F: 3518	Various	Depression, anxiety	K10	The incidence of depression and anxiety was found to be 35.3%.	Psychological interventions that reduce nervousness and negative coping style need to be made available to home-quarantined university students
Liu et al. (2021); cross-sectional	Australia	1718	Age: 21 (8.02) M: 49; F: 1227	Various	Depression, stress	PROMIS; PSS	736 (42.8%) participants exhibited clinical levels of depression symptoms.	Social isolation during the pandemic may contribute to depression symptoms both directly and through elevated stress levels.
Lopes and Nihei (2021); cross-sectional	Brazil	1224	Age: 18–24 (77.9%) M: 384 (31.4%) F: 840 (68.6%)	Various	Depression, anxiety, stress	DASS-21	Most of the undergraduates presented symptoms of depression (60.5%), anxiety (52.5%) and stress (57.5%).	The data indicate a high prevalence of symptoms of depression, anxiety and stress.
López Steinmetz et al. (2021); cross-sectional	Argentina	2687	Age: 22.7 (3.64) M: 17.6% F: 81.5% O: 0.9%	Various	Depression, anxiety	BDI-II; STAI	There were differences in psychological well-being/discomfort, social functioning and coping, psychological distress, and negative alcohol-related consequences.	A mental health state during quarantine suggests that quarantine and its extensions contribute to negative mental health impacts
Lukács (2021); cross-sectional	Hungary	421	Age: 26.5 (8.53) M: 31.6 F: 67.5	Various	Depression	CES-D	Students experienced significant negative changes after 4–6 weeks of confinement.	Findings suggest that the pandemic with its associated social isolation measures negatively affected students' everyday life and well-being.
McLafferty et al. (2021); cross-sectional	Ireland	884	Age: 21 M: 222 (39.4%) F: 652 (60.3%)	Various	Depression, anxiety	PHQ-9; GAD-7	Levels of depression increased significantly in year 2, however, levels of anxiety decreased.	The study reveals variation in symptoms of depression and anxiety since the onset of the pandemic.
Meda et al. (2021); cohort	Italy	358	Age: 21.3 (2.1) M: 21.7 (2.2) F: 21.3 (2.1)	Medicine and Surgery, Psychology, Biology, Pharmacy, Economics, Engineering, and Social and Political Sciences.	Depression, anxiety,	BDI-II, BAI	Students reported on average worse depressive symptoms during lockdown than 6 months before isolation.	Depressive symptomatology may be aggravated during lockdown.
Mehus et al. (2021); cohort	USA	727	Age: 18 (93.9%) M: 263 (36.2%) F: 464 (63.8%)	Various	Depression, anxiety,	PHQ-9; GAD-7	The most consistent predictor of during-pandemic mental health was feeling extremely isolated.	Feelings of isolation may be an important risk factor to include when assessing students' mental health.
Morris et al. (2021); cohort	USA	400	Age: NR M: 49.2% F: 49.8% O: 1%	Various	Depression, anxiety, stress	BDI-II; STAI; PSS	Individuals reporting higher indicators of depression, anxiety, and loneliness.	Students who used more problem-focused forms of coping reported fewer mental health symptoms over the course of the pandemic, even though they perceived their stress as more severe.
Moy and Ng (2021); cross-sectional	Malaysia	366	Age: 23 (8.0) M: 79 (21.6%)	Medicine, Engineering, Science	Depression, anxiety, stress	DASS-21	The levels of stress, anxiety and depression were 56.5%, 51.3% and 29.4%, respectively.	The mental status of university students was greatly affected during the COVID-19 pandemic.

(*continued on next page*)

Table 3 (*continued*)

Reference; study design	Country	Sample Size	Age and sex (mean/ SD/%)	Graduation course	Mental health variables	Instrument	Main results	Conclusion
			F: 287 (78.4%)					
Mushtaque et al. (2022); cross-sectional	Pakistan	438	Age: 26–30 (37.7%) M: 249 (56.8%) F: 189 (43.2%)	Various	Anxiety	CAS	The excessive use of mobile phones for to get information about the pandemic caused anxiety.	That the COVID- 19 outbreak greatly affected students' massive mobile phone use and psychosocial well-being.
Nugraha et al. (2023); cross-sectional	Indonesia	729	Age: 20 (1.5) M: 174 (23.9%) F: 555 (76.1%)	Medicine	Depression, anxiety, stress	DASS-21	Concerning mental health, the prevalence of reported symptoms of depression, anxiety, and stress were 45.4%, 65.2%, and 60.9%, respectively.	Associations including SARS-CoV-2 infection and comorbidities experienced by the students, the health of their families, including grief following bereavement, and the effects of social isolation during the pandemic.
Okado et al. (2021); cross-sectional	USA	228	Age: 21.29 (4.67) M: 69 (32.7%) F: 138 (65.4%) O: 3 (1.4%)	Various	Depression, anxiety, stress	DASS-21; PHQ-15	Elevated symptoms of depression, anxiety, perceived stress.	College students reported experiencing a wide range of stressors related to the pandemic.
Ortenburger et al. (2021); cross-sectional	Ukraine and Poland	1012	Age: NR M: 477 F: 535	Physiotherapy, Physical education, Command and staff, Law and Military administration	Anxiety	STAI	The pandemic situation affected a level of state-anxiety above average even when students felt social support.	Chosen factors had a partial influence on the anxiety level of students, therefore their mental health should concern shaping positive nutrition habits and social support.
Ramesh et al. (2022); cross-sectional	India	1000	Age: 18–24 (72.8%) M: 327 (32.7%) F: 673 (67.3%)	Odontology	Anxiety	Online questionnaire	All the respondents felt that being engaged, sharing their worries would help them, and mental health help requirement is greater in students.	During the pandemic, even though respondents were aware of the possible squeal of infection and preventive measures.
Romeo et al. (2021); cross-sectional	Italy	956	Age: 23.4 (2.7) M: 108 (22.6%) F: 370 (77.4%)	Various	Depression, anxiety	STAI-Y; BDI-II	University reported higher levels of anxiety and depressive symptoms.	University students have a high risk of developing mental health symptoms because of the COVID-19 pandemic.
Sakai et al. (2022); cross-sectional	Japan	281	Age: 21 (50.9%) M: 43 (15.3%) F: 238 (84.7%)	Nursing	Depression, anxiety,	HADS-A; HADS-D	The prevalence of anxiety (30.5%) and depressive symptoms (31.1%) were remarkably high.	Support and preventive strategies for mental health problems for college students during the COVID-19 pandemic regardless of perceived vulnerability
Seffrin et al. (2021); quasi-experimental study	Brazil	40	Age: 22.3 (3.8) M: 10 F: 30	Medicine, biomedicine	Depression, anxiety	PHQ-9; GAD-7	There was a significantly lower frequency of depression symptoms after the return to online classes.	Return to online classes positively affected the mental health.

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Table 3 (*continued*)

Reference; study design	Country	Sample Size	Age and sex (mean/ SD/%)	Graduation course	Mental health variables	Instrument	Main results	Conclusion
Silisteanu et al. (2021); cross-sectional	Romania	334	Age: NR M: 162 F: 172	Physical education and sports	Anxiety	Self-reported questionnaire	There is a positive correlation between physical condition, physical activity, emotional and cognitive signs.	The COVID-19 pandemic affected the physical and mental state, with a greater resonance for youth, especially pupils and students.
Sun et al. (2020); cross-sectional	China	255	Age: 20.9 (2.3) M: 13% F: 87%	Various	Depression	CES-D-10	That perceived available peer support negatively contributed to depressive symptoms.	University students showed signs of elevated depressive symptoms during the pandemic.
Szkody et al. (2021); cross-sectional	USA	422	Age: 19.7 (2.1) M: 34.8% F: 65%	Various	Stress	PSS	Time in self-isolation was taken into account, perceived social support buffered the connection between worry about COVID-19 and psychological health.	Social support, worry about COVID-19, and self-isolation may influence individuals' psychological health during times of stress.
Tahara et al. (2021); cross-sectional	Japan	223	Age: 21 (46.2%) M: 21.5% F: 78.5%	Medical sciences	Anxiety	GHQ-12	Approximately 70% of 223 respondents had poor mental health.	The study showed that the mental health of students declined during self-quarantine, and loneliness could be the major reason.
Tang et al. (2020); cross-sectional	China	2485	Age: 19.8 (1.5) M: 960 F: 1525	Various	Depression	PHQ-9	Participants with probable depression or posttraumatic stress disorder also reported more severe alexithymia features, such as difficulties in identifying feelings or describing feelings.	The results suggested that implementing strategies to assist young people identify and deal with their own emotions and those of others could prevent or mitigate the mental health problems associated with deadly pandemic events.
Tasnim et al. (2020); cross-sectional	USA	3331	Age: 21.4 (1.9) M: 59.4% F: 40.6%	Various	Depression, anxiety, stress	DASS-21	The prevalence estimate of suicidal ideation was 12.8%. Potential risk factors included depression, anxiety and stress.	Suicidal ideation was prevalent among university students during the onset of the COVID-19 pandemic
Uğurlu et al. (2021); cross-sectional	Turkey	411	Age: 22.02 (6.39) M: 42 F: 194; O: 21	Nursing	Depression, anxiety, stress	DASS-42	There was no significant relationship between depression and restrictive eating.	It was determined that the COVID-19 pandemic process affected the mental health of nursing students and their eating behaviors
Vasconcelos et al. (2021); cohort	Portugal	146	Age: 19.5 (1.5) M: 19% F: 81%	Various	Depression, anxiety, stress	DASS-21	Stress, anxiety, and depression symptoms did not contribute to explain changes in drinking behavior.	Binge drinkers in young Portuguese college students can be stopped when the contexts in which alcohol intake usually takes place are suppressed.
Wang and Jia (2023); cross-sectional	China	1437	Age: 19.5 (1.5) M: 54.9% F: 45.1%	Various	Depression, anxiety	SCL-90-R	Anxiety and terror two factors were significantly higher than the national normal.	College students are prone to psychological problems in the context of the epidemic.

Legenda = SD, Standard Deviation; %, Frequency Relative; NR, Does not report; NA, Not applied; M, Male; F, Female; O, Other.

support did not significantly alleviate anxiety and depression, with some studies finding that even students with social support experienced elevated symptoms (Ortenburger et al., 2021). Additionally, the feeling of belonging was found to be more effective in reducing depression symptoms than anxiety (Gopalan et al., 2022), while self-isolation was directly linked to higher levels of depression (Giovenco et al., 2022).

Other studies identified additional factors influencing mental health during the pandemic. Excessive use of mobile phones to access information about the pandemic contributed to increased anxiety (Mushtaque et al., 2022), while stress related to COVID-19 directly influenced symptoms of sexual compulsion (Deng et al., 2021), though not food restriction (Uğurlu et al., 2021). Stress was also found to have an indirect influence on depression and anxiety (Deng et al., 2021). Students with depression symptoms experienced difficulty identifying or expressing their feelings (Tang et al., 2020), leading to a reduction in their well-being (Evans et al., 2021). However, returning to online classes led to significant improvements in depression symptoms (Seffrin et al., 2021). Furthermore, social isolation had a direct impact on stress and mental health management (Bussone et al., 2020), with students reporting moderate (81.2%) and high (11.5%) stress levels (Bijulakshmi et al., 2020). For student-athletes, changes in athletic identity mediated the effects of social support from teammates on psychological well-being and symptoms of depression (Graupensperger et al., 2020).

In conclusion, anxiety, depression, and stress were the most prevalent psychological issues for university students during the COVID-19 pandemic. These findings highlight the need for targeted mental health interventions to manage anxiety, reduce stress, and provide emotional support, particularly during prolonged crises.

3.4. Other variables associated with the impact of the pandemic on university students' mental health

During the COVID-19 pandemic, various factors related to the mental health of university students were observed, including sleep quality, substance use, suicidal ideation, physical exercise practice, and academic performance.

Sleep quality was a recurring concern in several studies. University students reported high levels of insomnia (Amerio et al., 2022; Fila-Witecka et al., 2022) and sleep disturbances (Gonçalves et al., 2021; Kotera et al., 2021) during social isolation. Some authors suggest that maintaining good sleep hygiene can act as a protective factor for mental health (Fila-Witecka et al., 2021). However, one study reported that sleep quality was not affected during the pandemic (Evans et al., 2021).

Additionally, the pandemic also impacted substance use and suicidal ideation among university students. Increased anxiety was associated with the fear of viral infection (Chi et al., 2020; Fedorenko et al., 2021), and along with the severity of depression, anxiety, and stress symptoms, there was an increase in alcohol and drug use (Dogan-Sander et al., 2021; Fila-Witecka et al., 2022; López Steinmetz et al., 2021), as well as suicidal ideation (Dogan-Sander et al., 2021; Leaune et al., 2022; Tasnim et al., 2020). However, one study suggested that stress, anxiety, and depression were not explanatory factors for changes in alcohol consumption behavior, highlighting that excessive drinking could cease when the contexts in which consumption occurs were suppressed (Vasconcelos et al., 2021)

Regarding physical exercise practice, a reduction in this activity was associated with sleep disturbances (Fila-Witecka et al., 2022), the severity of stress symptoms (Gallego-Gómez et al., 2020), and emotional changes (Silisteanu et al., 2021). The research pointed to a significant correlation between mental health and regular physical exercise and its duration (Deng et al., 2020).

Finally, the impact of the pandemic on mental health was also reflected in students' academic performance. Anxiety symptoms related to online learning directly affected academic performance, as well as concerns about the future of the profession (Chinna et al., 2021). Procrastination fully mediated the impact of depression on academic performance (Freyhofer et al., 2021). The health outcomes identified in the studies included in this review are shown in Fig. 2.

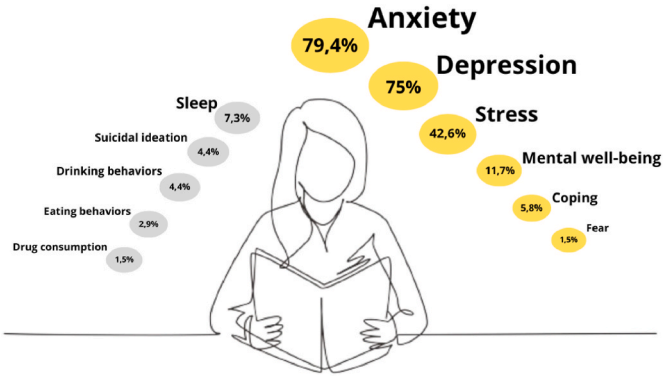

Fig. 2. Frequencies of psychological and mental health variables assessed in the included studies (n = 68).

3.5. Assessment of study quality

All 68 studies included in the review were assessed using the JBI critical appraisal checklists for cross-sectional (Table 4), cohort (Table 5), and quasi-experimental studies (Table 6). Among these, 34 studies were classified as low risk of bias, 30 as moderate risk, and 4 as high risk.

Studies with moderate or high risk of bias showed limitations primarily due to the absence or lack of clarity in addressing key methodological elements. Many did not identify or implement strategies to control for confounding factors, making it challenging to attribute outcomes directly to the exposure. Some also failed to ensure participants were free of the outcome at the start, an important condition for establishing causality—particularly relevant in studies on the COVID-19 pandemic, where pre-existing mental health conditions could have influenced the results. Additionally, outcome measures were not always applied using valid and reliable methods, affecting the precision of findings in certain cases. Issues such as insufficient or undefined follow-up periods and the absence of control groups or pre- and post-intervention measurements further limited the ability to establish clear causal relationships.

Despite these considerations, only four studies were categorized as having a high risk of bias. Studies with moderate risk maintained sufficient methodological rigor to ensure the reliability of their findings, reinforcing the robustness and validity of this review's overall conclusions.

4. Discussion

The current study aimed to analyze the impact of social isolation during the COVID-19 pandemic on the mental health of university students and to propose recommendations for the post-pandemic period. Regarding the nationality of the 177,537 students investigated in the 68 studies included in this review, they came from 29 countries, demonstrating the concern with the mental health of university students in much of the world during the pandemic and the period of confinement (Mushtaque et al., 2022; Nugraha et al., 2023; Tang et al., 2020; Wang and Jia, 2023). The current systematic review addresses recent findings and summarizes the impact of the COVID-19 pandemic on university students, presenting results on the mental health of university students studied during the pandemic, and as well as analyses of the instruments applied to assess university students.

This broad analysis of assessment instruments not only enriches the depth of the analysis, but also increases the possibility of reproducibility in future research (Barros and Sacau-Fontenla, 2021). Furthermore, it

Table 4
Critical appraisal results of eligible Analytical Cross-Sectional studies.

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total %
Abdullah et al., 2021	Y	Y	Y	Y	N	Y	Y	Y	87
Alsoghair et al., 2023	N	U	Y	Y	Y	Y	Y	Y	75
Amerio et al., 2022	Y	Y	Y	Y	Y	Y	Y	Y	100
Appleby et al., 2022	N	N	Y	Y	N	U	Y	Y	50
Arsandaux et al., 2021	N	N	Y	Y	Y	Y	Y	Y	75
Baiu et al., 2020	N	N	Y	Y	U	N	Y	Y	50
Baloch et al., 2021	N	N	Y	Y	U	Y	Y	Y	62
Barros and Sacau-Fontenla, 2021	N	U	Y	Y	N	N	Y	Y	75
Bijulakshmi et al., 2020	N	N	Y	Y	N	N	Y	Y	50
Bussone et al., 2020	N	N	Y	Y	Y	Y	Y	Y	75
B. Chen et al., 2020	N	U	Y	Y	Y	Y	Y	Y	75
Chen and Lucock, 2022	N	Y	Y	Y	Y	Y	Y	Y	87
Chi et al., 2020	N	N	Y	Y	Y	Y	Y	Y	75
Chinna et al., 2021	N	N	Y	Y	N	N	Y	Y	50
Deng et al., 2020	N	N	Y	Y	Y	U	Y	Y	62
Deng et al., 2021	U	N	Y	Y	U	N	Y	Y	50
Dogan-Sander et al., 2021	Y	Y	Y	Y	Y	Y	Y	Y	100
Ehmke et al., 2022	U	N	Y	Y	U	U	Y	U	62
Faez et al., 2020	N	N	Y	Y	U	U	Y	U	37
Fedorenko et al., 2021	Y	Y	Y	Y	U	U	Y	Y	75
Fila-Witecka et al., 2021	N	N	Y	Y	U	U	Y	Y	50
Fila-Witecka et al., 2022	N	N	Y	Y	U	U	Y	Y	50
Fruehwirth et al., 2021	N	N	Y	Y	U	U	Y	Y	50
Fu et al., 2021	N	N	Y	Y	Y	Y	Y	Y	75
Gallego-Gómez et al., 2020	U	U	Y	Y	U	U	Y	Y	50
Gao et al., 2021	U	U	Y	Y	U	U	Y	Y	50
Gestsdottir et al., 2021	Y	U	Y	Y	U	U	Y	Y	62
Giovenco et al., 2022	N	N	Y	Y	U	U	Y	Y	50
Giusti et al., 2020	U	U	Y	Y	U	U	Y	Y	50
Gonçalves et al., 2021)	Y	Y	Y	Y	N	N	Y	Y	75
Graupensperger et al., 2020	Y	Y	Y	Y	N	U	Y	Y	75
Holm-Hadulla et al., 2021	Y	U	Y	Y	N	N	Y	Y	62
Husky et al., 2020	Y	Y	U	N	N	N	Y	Y	50
Keshavarzi et al., 2021	Y	U	Y	U	N	N	Y	Y	50
Kotera et al., 2021	Y	Y	Y	Y	N	U	Y	Y	75
Leaune et al., 2022	Y	Y	Y	Y	N	N	Y	Y	75
Li et al., 2022	Y	Y	Y	Y	N	U	Y	Y	75
Liu et al., 2021	Y	U	Y	Y	Y	Y	Y	Y	87
Lopes and Nihei, 2021	Y	Y	Y	Y	N	N	Y	Y	75
López Steinmetz et al., 2021	Y	Y	Y	Y	Y	N	Y	Y	87
Lukács, 2021	Y	U	Y	Y	Y	U	Y	Y	75
McLafferty et al., 2021	Y	Y	Y	Y	N	N	Y	Y	75
Moy and Ng, 2021	U	U	Y	Y	N	N	Y	Y	50
Mushtaque et al., 2022	Y	Y	Y	Y	N	N	Y	Y	75
Nugraha et al., 2023	N	Y	Y	Y	Y	Y	Y	Y	87
Okado et al., 2021	Y	Y	Y	Y	N	U	Y	Y	75
Ortenburger et al., 2021	Y	Y	Y	U	N	N	Y	Y	62
Ramesh et al., 2022	Y	Y	U	U	N	N	Y	U	37
Romeo et al., 2021	Y	Y	Y	Y	N	N	Y	Y	75
Sakai et al., 2022	Y	U	Y	Y	N	U	Y	Y	62
Silisteanu et al., 2021	N	N	Y	Y	N	N	Y	U	37
Sun et al., 2020	Y	Y	Y	U	N	N	Y	Y	62
Szkody et al., 2021	Y	U	Y	Y	Y	Y	Y	Y	87
Tahara et al., 2021	Y	Y	Y	U	N	N	Y	Y	62
Tang et al., 2020	Y	Y	Y	Y	N	N	Y	Y	75
Tasnim et al., 2020	Y	Y	Y	Y	N	U	Y	Y	75
Uğurlu et al., 2021	Y	U	Y	Y	N	N	Y	Y	62
Wang and Jia, 2023	Y	Y	Y	Y	N	U	Y	Y	75

Legenda: Y = Yes; N = No; U = Unclear; JBI critical appraisal results of Analytical Cross-Sectional studies: **Q1** = Were the criteria for inclusion in the

sample clearly defined?; **Q2** = Were the study subjects and the setting described in detail?; **Q3** = Was the exposure measured in a valid and reliable way?; **Q4** = Were objective, standard criteria used for measurement of the condition?; **Q5** = Were confounding factors identified?; **Q6** = Were strategies to deal with confounding factors stated?; **Q7** = Were the outcomes measured in a valid and reliable way?; **Q8** = Was appropriate statistical analysis used? **Green color** = Low risk of bias; **Yellow color** = Moderate risk of bias; **Red color** = High risk of bias.

Table 5
Critical appraisal results of eligible Cohort studies.

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Total %
Elmer et al., 2020	Y	Y	Y	U	U	N	Y	U	U	U	Y	45
Evans et al., 2021	Y	Y	Y	Y	U	N	Y	U	N	U	Y	54
Freyhofer et al., 2021	Y	Y	Y	Y	Y	N	Y	U	N	U	Y	63
Gopalan et al., 2022	Y	Y	Y	N	N	Y	Y	U	Y	NA	Y	63
Johansson et al., 2021	N	Y	Y	N	U	Y	Y	Y	Y	NA	Y	54
Meda et al., 2021	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100
Mehus et al., 2021	Y	Y	Y	N	N	Y	Y	Y	Y	NA	Y	72
Morris et al., 2021	Y	Y	Y	N	U	Y	Y	Y	Y	NA	Y	72
Vasconcelos et al., 2021	Y	Y	Y	N	N	Y	Y	U	Y	Y	Y	72

Legenda: **Y** = Yes, **N** = No, **NA** = Not applicable; JBI critical appraisal results of eligible Cohort studies: **Q1** = Were the two groups similar and recruited from the same population?; **Q2** = Were the exposures measured similarly to assign people to both exposed and unexposed groups?; **Q3** = Was the exposure measured in a valid and reliable way?; **Q4** = Were confounding factors identified?; **Q5** = Were strategies to deal with confounding factors stated?; **Q6** = Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?; **Q7** = Were the outcomes measured in a valid and reliable way?; **Q8** = Was the follow up time reported and sufficient to be long enough for outcomes to occur?; **Q9** = Was follow up complete, and if not, were the reasons to loss to follow up described and explored?; **Q10** = Were strategies to address incomplete follow up utilized?; **Q11** = Was appropriate statistical analysis used? **Green color** = Low risk of bias; **Yellow color** = Moderate risk of bias; **Red color** = High risk of bias.

Table 6
Critical appraisal results of eligible Quasi-experimental studies.

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total %
Seffrin et al., 2021	Y	U	Y	N	N	N	Y	Y	Y	55

Legend: **Y** = Yes, **N** = No, **NA** = Not applicable; JBI critical appraisal results of eligible Quasi-Legenda: experiental studies: **Q1** = Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?; **Q2** = Were the participants included in any comparisons similar?; **Q3** = Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?; **Q4** = Was there a control group?; **Q5** = Were there multiple measurements of the outcome both pre and post the intervention/exposure?; **Q6** = Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?; **Q7** = Were the outcomes of participants included in any comparisons measured in the same way?; **Q8** = Were outcomes measured in a reliable way?; **Q9** = Was appropriate statistical analysis used? **Yellow color** = Moderate risk of bias.

allows the study not only of evident symptoms in university students, but also of other aspects resulting from anxiety, depression and stress, such as changes in sleep quality (Amerio et al., 2022; Evans et al., 2021; Fila-Witecka et al., 2021, 2022; Gonçalves et al., 2021; Kotera et al., 2021), fear of viral infection (Chi et al., 2020; Fedorenko et al., 2021), increased alcohol and drug consumption (Dogan-Sander et al., 2021; Fila-Witecka et al., 2022; López Steinmetz et al., 2021), and suicidal ideation (Dogan-Sander et al., 2021; Leaune et al., 2022; Tasnim et al., 2020). Within this context, understanding the mental health of university students enables greater understanding of the need to implement intervention programs for this population (Alsoghair et al., 2023).

4.1. Impact of social isolation caused by the COVID-19 pandemic on anxiety, depression, and stress among university students

Of the studies, 79.4% addressed anxiety, 75% depression, and 42.6% stress. Emerging evidence suggests that a considerable proportion of university students may experience psychological alterations and persistent symptoms that can be potentially detrimental to academic performance (Nugraha et al., 2023), mental health (Amerio et al., 2022) and physical health (Silisteanu et al., 2021), requiring early detection and intervention strategies (Bijulakshmi et al., 2020).

In the current review, 92.6% of the studies included students of both sexes and 1.5% of the studies included only women. This population is widely studied because women present a higher risk of mental health disorders (Campos et al., 2022; Pappa et al., 2020), being more affected in situations of social isolation (Elmer et al., 2020), and presenting more symptoms of anxiety, depression, and stress (Abdullah et al., 2021; Chen and Lucock, 2022; Gestsdottir et al., 2021), as well as less resilience (Ehmke et al., 2022). Serafim et al. (2021) highlight greater symptoms of depression, anxiety and stress during the COVID-19 pandemic in women without children, and students (Serafim et al., 2021). In Brazilian mothers (n = 822), Chociay et al. (2023) found a higher depression score in women who became unemployed during the pandemic and who felt a greater burden in caring for their children (Chociay et al., 2023). Wathelet et al. (2020) (Wathelet et al., 2020) reported that 11.4% of the students studied reported suicidal thoughts, in line with the findings of Dogan-Sander et al. (2021), Leaune et al. (2022) and Tasnim et al. (2020), who address anxiety, depression, and stress as potential risk factors for suicidal ideation.

Stress, investigated in 42.6% of the studies and in isolation in 5.8% of these (Bijulakshmi et al., 2020; Gallego-Gómez et al., 2020; Keshavarzi et al., 2021; Szkody et al., 2021), was shown to be elevated in most university students during the COVID-19 pandemic and was associated with symptoms of anxiety, depression (Nugraha et al., 2023; Serafim et al., 2021; Shah et al., 2021) and sleep quality Esteves et al. (2021);

Kshirsagar et al. (2021); Throughout 2020, the COVID-19 pandemic led to a 27.6% increase in cases of depressive disorders and a 25.6% increase in cases of anxiety disorders (Daly and Robinson, 2022). These findings corroborate those found in the current review, highlighting that anxiety increased from 18.1% before the pandemic to 25.3% in the first four months of social isolation and that depression increased from 21.5% to 31.7% (Fruehwirth et al., 2021), with a substantial increase in depression after six months (Meda et al., 2021).

Furthermore, authors highlighted that at the beginning of the COVID-19 pandemic, individuals presented more symptoms of anxiety and depression, taking into account that the meaning of life was the strongest predictor of depression, while sleep quality was the strongest predictor of anxiety (Simjanoski et al., 2022). However, in the face of negative life events, such as a pandemic situation, symptoms of anxiety and depression are followed by resilience (minimal effect on symptoms of anxiety, depression, or both) or recovery (initial short-term increase in symptoms of anxiety, depression, or both, followed by recovery) (Daly and Robinson, 2022). In this sense, it was found that during the pandemic, anxiety (Chen and Lucock, 2022; Ortenburger et al., 2021) and depression (Liu et al., 2021) exceeded clinical limits, but that in the second year of the pandemic, there was a significant reduction in symptoms (McLafferty et al., 2021).

Some authors suggest that regardless of the associated changes in symptoms of anxiety and depression during social isolation, concern about academic performance and school confinement remained, with the latter being more associated with symptoms of depression (Hawes et al., 2022). These findings corroborate those found in the current review, since anxiety symptoms related to online learning directly impacted academic performance and concern about the future of the profession (Chinna et al., 2021). Furthermore, procrastination during social isolation fully mediated the impact of depression on academic performance (Freyhofer et al., 2021).

The COVID-19 pandemic brought major changes to the lifestyle of university students (Chang et al., 2021), demonstrating in this review that with the reduction in physical exercise, students presented more insomnia (Fila-Witecka et al., 2022), stress (Gallego-Gómez et al., 2020) and emotional alterations (Silisteanu et al., 2021).

4.2. Impact of social isolation caused by the COVID-19 pandemic on sleep quality among university students

Upon entering the university environment, reduced sleep quality is reportedly prevalent among students, and has been associated with a range of adverse health outcomes, including reduced academic performance (Schmickler et al., 2023). With the social isolation caused by the COVID-19 pandemic, sleep quality was further affected (Amerio et al., 2022; Evans et al., 2021; Fila-Witecka et al., 2021, 2022; Gonçalves et al., 2021; Kotera et al., 2021) with students experiencing insomnia (Amerio et al., 2022; Fila-Witecka et al., 2022) and sleep disturbance (Gonçalves et al., 2021; Kotera et al., 2021).

Understanding factors such as sleep quality in college students, as well as other psychological variables, such as coping strategies and mental well-being, is essential for developing effective management protocols that help students maintain healthy sleep and, consequently, better performance (Fila-Witecka et al., 2021; Gonçalves et al., 2021; Kotera et al., 2021). Sleep quality has been less widely investigated (7.3%) compared to other psychological approaches, and yet it is known that one of the protective factors for mental health is taking care of sleep hygiene and that improved sleep quality is directly related to improved mental health, especially symptoms of depression, anxiety, and stress (Fila-Witecka et al., 2021).

Lino et al. (2022) investigated sleep quality, symptoms of anxiety, depression, and stress among Brazilian physical therapists (n = 342) during the COVID-19 pandemic and found that the global prevalence of reduced sleep quality was 86%, with symptoms of anxiety and stress being higher in frontline workers (Lino et al., 2022). Ribeiro et al. (2023) analyzed the sleep quality of nurses who worked to combat COVID-19, and identified insomnia as the main disorder identified, with low self-care capacity being a determinant of impaired sleep patterns (Ribeiro et al., 2023).

High-quality sleep is an important factor in maintaining health and improving well-being, with positive associations observed between increased physical activity and reduced sedentary behavior and sleep quality (Koohsari et al., 2023). In this context, studies have analyzed the reduction in physical exercise among university students during the COVID-19 pandemic, highlighting that mental health was significantly correlated with regular physical exercise and its duration (Deng et al., 2020).

It is of utmost importance that this variable is better studied in relation to the general health of university students in pandemic contexts (Gonçalves et al., 2021) and that the university develop personalized interventions to promote healthy sleep in university students (Schmickler et al., 2023), since advanced age, lower social status, worse self-rated health, stress, exhaustion, and low academic performance are directly related to reduced sleep quality (Schmickler et al., 2023).

4.3. Mental health care for college students and recommendations for the post-pandemic period

In the post-pandemic context, prioritizing mental health is essencial for college students, particularly concering sleep quality and symptoms of anxiety and depression. Students should be encouraged to monitor their mental well-being and seek professional help promptly when issues arise. Early intervention can prevent the symptom escalation and facilitate effective treatment.

Further, maintaining a healthy lifestyle is essential in mitigating mental health challenges. Regular moderate physical exercise is recommended, as it has been shown to alleviate symptoms of anxiety and depression. Additionally, students should be advised on the importance of good sleep hygiene, proper nutrition, and stress management practices. Universities should support these efforts by promoting education on prevention and well-being, as well as providing access to counseling services.

Universities also have a responsibility to foster a safe, supportive, and inclusive environment for students. This includes ensuring access to mental health resources and creating spaces where students feel comfortable seeking help. Universities should actively promote mental health awareness and provide structured support systems, including peer networks and professional counseling.

Finally, students should be informed about vaccination programs and other health initiatives to reduce potencial health-related stressors. By adopting a holistic approach that combines personal responsibility, institutional support, and professional care, universities can effectively address the mental health needs of students in the post-pandemic period. The recommendations outlined by the authors are summarized in Fig. 3.

4.4. Strengths and practical applications

This review offers a comprehensive analysis of the mental health impacts of social isolation on university students during the COVID-19 pandemic, providing valuable insights into an area of significant concern. One of the main strengths of this work lies in its extensive and systematic approach. By synthesizing data from 68 studies, encompassing a large sample of 177,537 students, the review ensures a robust evidence base that enhances the generalizability and relevance of the findings. Additionally, the review adhered to the PRISMA guidelines, which further bolsters the reliability and transparency of the methodology.

The results of this review highlight the possibility of implementing effective strategies to mitigate the mental health challenges faced by students during periods of isolation. By focusing on key factors such as improving sleep quality, encouraging moderate physical activity, and

Fig. 3. Recommendations for the post-pandemic period.

raising mental health awareness, the review provides actionable recommendations that can be applied to support students not only in post-pandemic times but also in future crises. These practical applications are grounded in the data and emphasize proactive university support to create safe and inclusive environments for students.

Another notable strength of this review is its ability to incorporate studies of varying methodological rigor. While some studies had moderate or high risk of bias, the overall consistency of the findings strengthens the confidence in the review's conclusions. This inclusive approach allows for a more nuanced understanding of the mental health impact and ensures that the recommendations are based on a broad spectrum of evidence.

In conclusion, the strengths of this review are reflected in its large, diverse sample, adherence to rigorous methodological standards, and its focus on providing actionable and relevant recommendations. These strengths make the findings particularly valuable for shaping future mental health interventions for university students, both during and beyond periods of social isolation.

4.5. Limitations and future studies

The articles included in this systematic review were predominantly (85.3%) cross-sectional, and a meta-analysis was not feasible. The majority of studies highlighted the worsening of psychological aspects; however, this relationship may not be directly attributable to COVID-19 due to the abscence of control variables prior to the pandemic and during the confinement period. This review also reveals that the lack of pre-pandemic data, such as information on pre-existing psychological disorders, poses a potencial confounding factors. Inconsistent data, lack of clarity in some studies, and the heterogeneity of assessment instruments are limiting factors that should be addressed in future research. Despite these limitations, the understanding of the impact of the COVID-19 pandemic on university students remains a relatively recent area of study. Nevertheless, it was possible to carefully summarize the existing knowledge in this systematic review. Future studies should focus on the assessment and management of students mental health, both in social isolation and in non-isolation contexts, considering the social and educational demands in the post-COVID-19 scenario.

5. Conclusion

The results of the current study highlight the negative impact of the COVID-19 pandemic on the mental health of university students. The most common symptoms observed were anxiety, depression, and stress, in that order. For other variables, such as coping mechanisms, sleep quality, fear, alcohol consumption, suicidal ideation, and overall mental well-being, although only a limited number of studies were identified, the findings consistently indicated negative outcomes for university students. To further investigate the pandemics negative effects on this population, more robust studies with greater methodological rigor and controlled experimental interventions are recommended. It is crucial to acknowledge that university students faced unique challenges during the pandemic, including disruptions to in person teaching and social interactions, as well as the need to adhere to health protocols. These factors may have significantly affected students' quality of life.

CRediT authorship contribution statement

Tamiris Beppler Martins: Writing – review & editing, Writing – original draft, Visualization, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Joaquim Henrique Lorenzetti Branco:** Software, Methodology, Investigation, Formal

analysis, Data curation, Conceptualization. **Taís Beppler Martins:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Data curation. **Gilmar Moraes Santos:** Writing – review & editing, Supervision. **Alexandro Andrade:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Funding acquisition.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bbih.2024.100941.

Data availability

No data was used for the research described in the article.

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